



Session 2: Citizen Science and Recreational Fisheries

D1

Reef Vision: Successfully Using Recreational Fishers to Monitor Artificial Reefs using Baited Remote Underwater Video Systems

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With the deployment of artificial reefs there are legislative, social, environmental and ecological requirements to monitor the performance of these structures. While monitoring undertaken by governments and scientific organisations can be cost and time prohibitive, the use of citizen scientists' can cost effectively gather large spatial and temporal data sets as well as grow the social values of participants. In South Western Australia local fishers were used to effectively monitor artificial reefs in a program called 'Reef Vision'. This program developed innovative technology, methodologies and a suite of engagement and management tools to effectively utilise fishers as citizen scientists. Between 2015 and 2016, twenty volunteer recreational fishers deployed custom designed Baited Remote Underwater Video systems (BRUVs) on two artificial reefs in Geographe Bay, Western Australia. Footage collected by these citizen scientists was analysed to see variations in fish assemblages over time and between the reefs as a measure to determine the performance of the reefs. Over 150 hours of footage was collected on the reefs over a year period which resulted in the discovery of over 34,000 individual fish from 65 species being observed. The success of this citizen science model has instigated its expansion to monitoring other habitat enhancement structures in Australia and its acceptance as a valid monitoring method by the federal government. Reef Vision highlights the ability of fishers to collect data to assist research and monitoring in a variety of different aquatic environments.



D2

Benefits and Challenges to Angler-Driven Recreational Fisheries Science

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Abundant and accessible target fish species are a necessary prerequisite for recreational anglers to be successful at their sport. Traditionally, government agencies have been held responsible for the maintenance of recreational fish stocks, however anglers themselves, often through grassroots non-government organizations, are taking the initiative to address questions related to management of recreational fisheries. Angler involvement in recreational fisheries research can range from simply sharing insights and catching fish to be used in the studies, to direct participation in experimental design, fundraising, and project coordination and implementation. Each level of participation comes with its own level of personal and group investment, both on the part of the recreational anglers and the scientists involved. Based on our experience with angler-driven catch-and-release science, we present a framework for managing expectations for both recreational anglers and fisheries scientists as they develop collaborative research efforts, execute studies, and ultimately share responsibility for dissemination of the results. We believe there is great power in collaborative research between anglers and recreational fisheries scientists, but only if a mutual understanding of each other's boundaries is established early and maintained throughout the research process.



D3

The Importance of Citizen Science in Conjunction with Larger Scale Projects

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Recreational fishing is a highly heterogeneous activity which involves a number of sub-groups (e.g. catch and release anglers), responding to a variety of catch and non-catch related motivations. This heterogeneity means that calculating an “average angler” or presuming “satisfaction” with an angling experience is not a “one size fits all” measure. It is rather dependent on the individual and the context. Overall, the population of people that fish is numerically dominated by “casual” anglers. Avid recreational fishers represent a small proportion of the angling population (<10%), however these avid anglers tend to have the most invested in the activity from a social, psychological, political and economic perspective. To date the majority of recreational fishing data collection in Australia has focussed on large statewide or national surveys. They provide broad-scale data, but limited information on the specific behaviours and motivations of recreational fishers. In effect, they homogenise the highly heterogeneous activity that is recreational fishing. Citizen science represents a cost-effective approach to collect fine-scale information on the recreational fishing activities of avid anglers who are the focus of traditional fisheries management. A recreational salmonid fishery in New Zealand (South Island) is presented as a case study of the fine scale data that can be collected using a citizen science approach. The assumptions and common conclusions of broad scale creel surveys are tested against this data. The more common use of data such as this can lead to more realistic iterative management, improved understanding of the activities, benefits and role in managing and being managed of this critical group of recreational anglers.



D4 Sampling Juvenile Fish Habitats with Engaged Community Members – Småfisk2017

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Whilst monitoring the health of adult fish stocks and their contributions to recruitment can be made through fisheries data and genetics, many fish populations are regulated by processes occurring at settlement and through the juvenile stages. Quantifying the contributions of different juvenile habitats to adult stocks is therefore important for tracking fish production through their entire life history. However, monitoring a large coastline simultaneously is logistically demanding and costly. For marine fish, these juvenile habitats are often found in shallow coastal areas which overlap with areas utilised by amateur and recreational fisheries. In this study, we capitalise on this overlap of human activity and natural occurrence to cover the full extent of the Inner Danish waters over an entire settlement and growth period. The collaboration with recreational fishers and local nature schools provides data on an important factor determining habitat productivity, rates of settlement, in habitats around the Inner Danish waters. Using adapted fyke nets, designed in collaboration with the Danish Amateur Fishers Association, volunteers fished overnight once every two weeks from April to September, whilst identifying, recording and collecting samples. Here we present the current findings from this presently under-way project and our experiences working with different contributors to date.



D5

Using Anglers to Map Coastal Fisheries Habitat

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The utilization of anglers to report fishing effort and catch is a widely-used practice in commercial and recreational fisheries management. However, using fishers to analyze habitat characteristics is less common. The increase of coastal development and alteration of water flows in desirable locations has vastly diminished coastal habitats in both quality and quantity. Many of these coastal habitats serve as vital nursery habitats for juvenile fishes. Atlantic tarpon (*Megalops atlanticus*), which support a valuable recreational fishery, are among the species that use a coastal habitat mosaic during early life stages. Disruptions of this habitat mosaic could have lasting impacts on the adult fishery that may not be realized for decades due to their relatively slow maturation rate and 80-year longevity. We collaborated with recreational anglers to assess juvenile tarpon habitat, and used a combination of angler- and scientist-based data to assess and rank juvenile habitats, with direct applications to management. Anglers identified habitat locations and provided assessments, which populated a regional-scale map. Scientists groundtruthed angler-identified sites and applied a habitat characteristic ranking system. The combined data are being used to prioritize habitat locations for protection and restoration, and are being incorporated into fisheries management.



D6

Great Tuna Race: A Unique Combination between Science and Recreational Responsible Fishing

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The ACPR (the Catalan Association for Responsible Fishing) is a recreational fishers' association whose main objective is to change the fishing values towards a more responsible and sustainable culture, thus, improving the state of the sea and its natural resources. Among other initiatives, and to achieve this goal, they created the Great Tuna Race (GTR) in 2014. The GTR is a unique citizen-science tagging event which combines Science, Research and Sports. Its objective is to catch, tag and release bluefin tuna in the Mediterranean and Eastern Atlantic to increase our knowledge on its biology and ecology. It takes place annually in collaboration with scientific institutions and with the support of ICCAT, the Government of Catalonia, and NGOs. The GTR was born in 2014, however, the ACPR had been collaborating with bluefin tuna tagging projects since 2008. Thanks to this long-term citizen-science study, remarkable results have been revealed regarding this amazing species: (1) some individuals do not leave the Mediterranean Sea once the spawning period ends, instead, they stay and spend the winter (and sometimes even longer) in the basin; (2) there might be higher mixing than expected between the Eastern and Western stocks, as an individual tagged in the Atlantic coast of Morocco which entered the Mediterranean (to possibly reproduce), ended up off the coast of Newfoundland (Canada); or (3) recent results are pointing to potential new locations and times for spawning. The GTR is adamant to continue to help to figure out all these question marks.



D7

Recreational Fisheries Data Collection Led by the Sportfishing Association of California (SAC)

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Founded in 1972, the Sportfishing Association of California (SAC) is a non-profit organization that represents the Commercial Passenger Fishing Vessel (CPFV) fleet. SAC has developed several impactful collaborations with state and federal fisheries managers to fill data gaps that are critical for effective management of local fisheries. In 2014, SAC developed a collaborative program approved by both California Department of Fish and Wildlife (CDFW) and NOAA to collect size structure data at-sea for all locally caught tunas. In 2016, SAC implemented a dockside Pacific Bluefin Tuna length-weight (L-W) measuring program. These data allowed the CDFW to generate new and more accurate L-W parameters, which yielded estimates of total weight that were approximately 7% less than original estimates. Additionally, SAC successfully implemented the electronic fishing logbook (e-logs) program using a new electronic platform developed by the CDFW. SAC distributed mobile tablets to every vessel in the fleet, and trained all captains in-person on e-log submissions. This program now provides fisheries data to the state in significantly less time than traditional paper logs. SAC has also worked with NOAA to mitigate for the effects of rockfish barotrauma by distributing fish descending devices to every CPFV in the fleet, and will soon establish a fillet length for California Sheephead. SAC recently completed a comparison between perceived impacts among CPFV captains of fisheries regulations with actual CPFV catch and effort, and the results showed strong agreement between both sources. This project suggests that CPFV captains are a valuable resource for informing fisheries management, especially with data limited stocks.



D8

The IGFA Great Marlin Race: A Citizen Science Approach to Billfish Satellite Tagging

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Over the last two decades, the advent and continued refinement of pop-up satellite archival tags (PSATs) have proved to be valuable research tools for large pelagic fishes such as billfish. However, their high cost, relative to conventional tags can be prohibitive to deploying large numbers of tags. One solution to this problem is engaging recreational anglers to help fund tagging initiatives; a concept that has been utilized by several research programs focusing on large pelagic fishes. Since 2011, the International Game Fish Association and Stanford University have been deploying PSATs on billfish around the world as part of the IGFA Great Marlin Race (IGMR). Working with billfish tournaments, recreational anglers sponsor individual tags and deploy them on billfish that are caught and released during and around tournaments. Here we describe results from the first five years during which the IGMR has deployed over 300 PSATs on seven species of billfish in 20 different countries and also deployed the first ever PSAT's on both Mediterranean and shortbilled spearfish. Information from each tagged fish is made available to the public on an interactive website and raw tag data are freely made available to other researchers.



D9

Fishing BC App - A Communication and Catch Data Gathering Collaborative Project

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The Fishing BC mobile app is a new online information and catch monitoring tool for recreational anglers developed in collaboration between the Sport Fishing Institute of BC and Fisheries and Oceans Canada (DFO) and funded, in part, by the Pacific Salmon Foundation. In its simplest form, the app allows DFO to provide recreational anglers with information about regulations, catch and possession limits, safety notices and species identification on an easily accessible mobile platform as a real time, rather than archived, format. The app will allow DFO to effectively narrowcast important fisheries information about openings, closures and other important safety and management decisions directly to anglers.

This one-way provision of fisheries regulations and management updates is only the first step, the app has been developed to serve as a two-way communication tool that will allow anglers to provide better information to fisheries managers which will, in turn, inform and shape management decisions and opportunities.

The app is capable of serving as an electronic fishing license and catch log, allowing anglers to permanently record any species that require notation on their licence. As the app develops further, managers will be able to gather catch monitoring information from anglers fishing in specific areas or by modes or at times that have not been possible to monitor effectively or at all.

A product and benefit to Fisheries and Oceans Canada, the development of the Fishing BC app required a reorganization of internal and outwards-facing communication pathways in order that the department could provide real time information. While this sort of a changes is commonplace in many businesses, it is relatively new for a large government department charged with natural resource regulation, and particularly one charged with regulating a 300,000-strong group of independent recreational anglers.



D10

Collaborating to Restore Australian Native Fish Communities Through Carp Biocontrol

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Though Common carp (*Cyprinus carpio*) is a valued sportfish and source of protein in many Asian and European countries they are not considered a desirable target by most Australian recreational fishers. Common carp now make up 80% of fish biomass in many Australian waterways, impacting on water quality and habitat, and outcompeting native fish species more highly prized for their sporting and culinary qualities.

The Australian Government recently announced a national program to address impacts caused by this pest species through use of a naturally occurring species-specific virus known as Cyprinid herpesvirus 3, or CyHV-3 (hereon referred to as the Carp virus) as a biological control agent. If successful, this will be the largest vertebrate pest fish biocontrol initiative undertaken worldwide.

A program of research has been initiated under the National Carp Control Plan to address key risks and remaining knowledge gaps. Monitoring will also be undertaken to adaptively inform the strategy for release of the Carp virus and subsequent clean-up activities, and to track ecosystem response.

This ambitious national program is fertile ground for citizen science as it aligns with community aspirations to recover Australian native fish populations, in doing so, improving the quality of recreational fishing outcomes. Australian researchers are trialing a suite of citizen science approaches to identify optimal approaches to engage Australian fishers, in doing so securing data necessary to adaptively inform implementation whilst also enhancing scientific literacy and support for this biocontrol initiative.